

Observations of the Moon, made at the Radcliffe Observatory, Oxford, during the year 1887, and a comparison of the Results with the Tabular Places from Hansen's Lunar Tables. By E. J. Stone, M.A., F.R.S.

The present paper contains the Right Ascensions and North Polar Distances of the Moon, as deduced from the observations made at the Radcliffe Observatory during the year 1887. These results are here compared with those deduced from Hansen's Lunar Tables on two suppositions:—

- (1) That the mean times, found in the usual way from the sidereal times at mean noon given in the *Nautical Almanac*, were *not* changed in 1864 by the adoption of a different unit of time.
- (2) That the mean times *were* changed in 1864 by the adoption of a different unit of time, in accordance with the views which I have explained in papers already communicated to the Society.

For facilities for an accurate comparison between Hansen's Lunar Tables and Observations we are again indebted to the places published in the *Connaissance des Temps*.

TABLE I.
Radcliffe Observations of the Moon, 1887.

Day, 1887.	Observer.	Observed R.A.	Seconds of Hansen's R.A.	Hansen minus Observed. Uncorrected for Error in Time.	Correction due to Error in Time.	Hansen minus Observed. Corrected for Error in Time.	Observed N.P.D.	Seconds of Hansen's N.P.D.	Hansen minus Observed. Uncorrected for Error in Time.	Correction due to Error in Time.	Hansen minus Observed. Corrected for Error in Time.
		^h ^m ^s	^s	^s	^s	^s	[°] ['] ^{''}	^{''}	^{''}	^{''}	^{''}
Jan. 4	W.	2 36 52.76	53.55	+0.79	-1.16	-0.37	79 47 35.98	33.67	-2.31	+5.02	+2.71
5	F. B.	3 28 43.54	44.41	+0.87	-1.23	-0.36	76 22 45.16	41.91	-3.25	+4.34	+1.09
6	W.	4 23 45.62	46.36	+0.74	-1.30	-0.56	73 34 13.55	11.57	-1.98	+3.33	+1.35
12	W.	10 32 26.16	27.58	+1.42	-1.36	+0.06	80 4 7.22	8.26	+1.04	-5.95	-4.91
16	R.	14 17 26.80	27.93	+1.13	-1.26	-0.13	98 41 7.79	11.53	+3.74	-5.78	-2.04
31	R.	2 16 7.06	7.60	+0.54	-1.12	-0.58	81 29 27.80	23.34	-4.46	+5.14	+0.68
Feb. 1	W.	3 5 33.72	34.35	+0.63	-1.17	-0.54	77 57 42.95	39.32	-3.63	+4.60	+0.97
2	F. B.	3 57 40.43	41.33	+0.90	-1.24	-0.34	74 54 48.68	44.24	-4.44	+3.79	-0.65
4	R.	5 51 35.23	35.83	+0.60	-1.38	-0.78	71 8 56.15	53.96	-2.19	+1.20	-0.99
5	F. B.	6 53 2.65	3.49	+0.84	-1.43	-0.59	70 54 12.16	11.43	-0.73	-0.54	-1.27
7	R.	9 0 1.13	2.16	+1.03	-1.45	-0.42	74 23 20.22	22.92	+2.70	-4.17	-1.47
28	F. B.	2 47 5.20	5.89	+0.69	-1.13	-0.44	79 13 10.15	7.03	-3.12	+4.77	+1.65
Mar. 2	R.	4 29 42.65	43.13	+0.48	-1.25	-0.77	73 25 49.71	46.16	-3.55	+3.09	-0.46
3	R.	5 25 8.55	9.14	+0.59	-1.31	-0.72	71 38 15.87	14.16	-1.71	+1.82	+0.11
4	R.	6 23 24.15	24.91	+0.76	-1.37	-0.61	70 51 10.61	8.24	-2.37	+0.30	-2.07
April 7	W.	12 59 15.23	16.30	+1.07	-1.38	-0.31	92 13 40.60	45.82	+5.22	-7.21	-1.99

Day, 1887	Observer.	Observed R.A.	Seconds of Hansen's R.A.	Hansen minus Observed. Uncorrected for Error in Time.	Correction due to Error in Time.	Hansen minus Observed. Corrected for Error in Time.	Observed N.P.D.	Seconds of Hansen's N.P.D.	Hansen minus Observed. Uncorrected for Error in Time.	Correction due to Error in Time.	Hansen minus Observed. Corrected for Error in Time.
May 5	F. B.	13 28 42.40	43.31	+0.91	-1.36	-0.45	94 43 34.49	39.20	+4.71	-7.01	-2.30
7	F. B.	15 27 57.62	58.99	+1.37	-1.40	-0.03	103 41 59.31	64.92	+5.61	-5.15	+0.46
9	R.	17 29 28.81	30.02	+1.21	-1.40	-0.19	108 51 52.73	54.17	+1.44	-1.91	-0.47
12	R.	20 22 11.07	12.40	+1.33	-1.25	+0.08	107 40 24.67	23.96	-0.71	+2.72	+2.01
13	F. B.	21 14 39.38	40.93	+1.55	-1.19	+0.36	105 19 50.22	46.33	-3.89	+3.79	-0.10
June 4	R.	15 59 49.23	50.45	+1.22	-1.40	-0.18	105 30 30.36	33.10	+2.74	-4.43	-1.69
8	F. B.	19 57 39.42	40.82	+1.40	-1.31	+0.09	108 39 53.85	53.31	-0.54	+2.15	+1.61
9	W.	20 52 23.57	24.99	+1.42	-1.25	+0.17	106 39 49.37	47.57	-1.80	+3.41	+1.61
10	F. B.	21 44 18.38	20.14	+1.76	-1.18	+0.58	103 52 52.63	49.23	-3.40	+4.36	+0.96
30	R.	14 39 36.61	37.46	+0.85	-1.33	-0.48	100 11 41.85	45.76	+3.91	-6.01	-2.10
July 2	R.	16 35 35.93	37.16	+1.23	-1.38	-0.15	107 8 9.46	11.90	+2.44	-3.52	-1.08
5	F. B.	19 32 36.92	38.48	+1.56	-1.34	+0.22	109 18 55.95	55.14	-0.81	+1.47	+0.66
7	F. B.	21 22 21.37	22.83	+1.46	-1.23	+0.23	105 17 50.40	46.02	-4.38	+3.99	-0.39
27	R.	14 22 49.38	50.26	+0.88	-1.32	-0.44	98 46 25.26	31.36	+6.10	-6.25	-0.15
29	R.	16 16 34.11	35.17	+1.06	-1.35	-0.29	106 10 53.08	55.69	+2.61	-3.97	-1.36
30	F. B.	17 14 38.08	39.44	+1.36	-1.37	-0.01	108 28 7.39	10.38	+2.99	-2.44	+0.55
Aug. 1	F. B.	19 10 42.80	43.89	+1.09	-1.34	-0.25	109 36 33.10	32.59	-0.51	+0.83	+0.32
2	R.	20 7 2.45	3.58	+1.13	-1.30	-0.17	108 29 9.92	6.92	-3.00	+2.30	-0.70
3	F. B.	21 1 17.31	18.67	+1.36	-1.25	+0.11	106 23 32.93	29.80	-3.13	+3.56	+0.43
4	R.	21 53 11.14	12.25	+1.11	-1.20	-0.09	103 30 61.57	57.28	-4.29	+4.53	+0.24

Correction to be subtracted from M.T. for change of Sidereal Time at Mean Noon since 1864.

Jan. 1888. <i>made at the Radcliffe Observatory.</i>										89	
Day, 1887.	Observer.	Observed R.A.			Observed N.P.D.	Hansen <i>minus</i> Observed. Corrected for Error in Time.		Correction due to Error in Time.	Hansen <i>minus</i> Observed. Uncorrected for Error in Time.		Seconds of Hansen's N.P.D.
		h	m	s		"	"		"		
Aug. 25	F. B.	15	59	37.1	105 16 33.77	0.01	-1.36	-4.43	+2.26	-2.17	36.03
27	F. B.	17	55	7.46	109 23 47.99	0.01	-1.36	-1.30	-0.29	-1.59	47.70
Sept. 28	R.	22	9	17.36	102 30 21.51	-0.11	-1.17	+4.79	-4.90	-0.11	16.61
Oct. 10	R.	8	11	2.51	71 24 34.29	-0.27	-1.38	-2.60	+2.79	+0.19	37.08
24	W.	21	2	17.73	106 38 16.87	-0.02	-1.25	+3.64	-4.16	-0.52	12.71
25	R.	21	53	33.64	103 44 11.59	-0.12	-1.19	+4.59	-5.46	-0.87	6.13
28	R.	0	15	46.65	92 17 42.16	-0.09	-1.09	+5.98	-5.18	+0.80	36.98
31	W.	2	34	23.99	80 4 59.97	-0.14	-1.13	+5.35	-4.33	+1.02	55.64
Nov. 1	R.	3	22	43.74	76 34 3.75	-0.05	-1.17	+4.67	-3.28	+1.39	0.47
4	R.	5	59	2.08	70 3 52.53	-0.40	-1.30	+1.18	-2.84	-1.66	49.69
24	F. B.	0	0	2.06	93 56 31.67	-0.02	-1.10	+5.99	-2.45	+3.54	29.22
29	R.	3	55	30.82	74 31 13.99	-0.36	-1.21	+4.22	-4.53	-0.31	9.46
Dec. 8	R.	12	14	6.89	87 12 14.17	-0.31	-1.32	-7.27	+3.13	-4.14	17.30
23	R.	1	13	56.56	87 20 27.58	-0.22	-1.10	+6.08	-4.85	+1.23	22.73
26	R.	3	35	43.63	75 49 38.90	-0.55	-1.20	+4.64	-4.31	+0.33	34.59
27	W.	4	26	50.45	72 55 40.01	-0.33	-1.25	+3.65	-3.82	-0.17	36.19
28	F. B.	5	20	27.93	70 48 39.40	-0.39	-1.31	+2.39	-3.79	-1.40	35.61
Mean of Errors, without regard to sign											1.229
Mean Errors for Year											3.191

Observers: W., Mr. W. Wickham; R., Mr. W. H. Robinson; F. B., Mr. F. A. Bellamy.

TABLE II.

Radcliffe Observations of the Moon, 1887.

Errors of the Moon's Tabular Place in Longitude and Ecliptic Polar Distance, "Uncorrected" and "Corrected" for the change in Tabular Mean Time introduced in the year 1864.

Day.		Errors of Longitude (Hansen minus Observed).		Errors of E.N.P.D. (Hansen minus Observed).	
		Uncorrected.	Corrected.	Uncorrected.	Corrected.
1887					
Jan.	4	+ 11 ^h 85	- 6 ^m 06	+ 1 ^h 43	+ 0 ^m 88
	5	+ 13 ^h 15	- 5 ^m 38	- 0 ^m 03	- 0 ^m 24
	6	+ 10 ^h 87	- 8 ^m 20	- 0 ^m 22	+ 0 ^m 02
	12	+ 19 ^h 88	- 0 ^m 99	- 6 ^m 77	- 4 ^m 89
	16	+ 17 ^h 14	- 2 ^m 50	- 1 ^m 99	- 1 ^m 29
Jan.	31	+ 9 ^h 07	- 8 ^m 37	- 1 ^m 56	- 2 ^m 21
Feb.	1	+ 9 ^h 94	- 7 ^m 92	- 0 ^m 95	- 1 ^m 25
	2	+ 13 ^h 72	- 4 ^m 71	- 1 ^m 70	- 1 ^m 64
	4	+ 8 ^h 56	- 11 ^m 08	- 2 ^m 07	- 1 ^m 15
	5	+ 11 ^h 82	- 8 ^m 46	- 1 ^m 78	- 0 ^m 52
	7	+ 15 ^h 05	- 6 ^m 24	- 1 ^m 60	+ 0 ^m 30
Feb.	28	+ 10 ^h 67	- 6 ^m 70	+ 0 ^m 04	- 0 ^m 35
March	2	+ 7 ^h 40	- 10 ^m 92	- 3 ^m 40	- 2 ^m 15
	3	+ 8 ^h 51	- 10 ^m 26	- 1 ^m 19	- 0 ^m 52
	4	+ 10 ^h 69	- 8 ^m 74	- 2 ^m 81	- 1 ^m 71
April	7	+ 16 ^h 84	- 5 ^m 06	- 1 ^m 37	- 0 ^m 04
May	5	+ 14 ^h 42	- 7 ^m 12	- 0 ^m 66	+ 0 ^m 35
	7	+ 20 ^h 81	- 0 ^m 31	+ 0 ^m 54	+ 0 ^m 55
	9	+ 17 ^h 26	- 2 ^m 72	+ 0 ^m 53	- 0 ^m 33
	12	+ 18 ^h 67	+ 0 ^m 65	+ 3 ^m 71	+ 2 ^m 22
	13	+ 22 ^h 55	+ 5 ^m 00	+ 2 ^m 97	+ 1 ^m 46
June	4	+ 17 ^h 90	- 2 ^m 90	- 0 ^m 84	- 1 ^m 14
	8	+ 19 ^h 66	+ 0 ^m 94	+ 3 ^m 38	+ 1 ^m 83
	9	+ 20 ^h 11	+ 1 ^m 91	+ 3 ^m 81	+ 2 ^m 21
	10	+ 25 ^h 31	+ 7 ^m 65	+ 5 ^m 24	+ 3 ^m 69
June	30	+ 13 ^h 20	- 7 ^m 42	- 0 ^m 12	+ 0 ^m 17

Day.		Errors of Longitude (Hansen <i>minus</i> Observed).		Errors of E.N.P.D. (Hansen <i>minus</i> Observed).	
		Uncorrected.	Corrected.	Uncorrected.	Corrected.
1887.					
July	2	+ 17.88	- 2.29	- 0.12	- 0.76
	5	+ 21.95	+ 2.97	+ 2.65	+ 1.14
	7	+ 21.42	+ 3.28	+ 2.32	+ 0.65
July	27	+ 14.39	- 6.25	+ 1.54	+ 1.98
	29	+ 15.56	- 4.37	- 0.10	- 0.61
	30	+ 19.58	+ 0.19	+ 1.44	+ 0.56
Aug.	1	+ 15.39	- 3.55	+ 1.35	- 0.11
	2	+ 16.36	- 2.22	+ 0.45	- 1.19
	3	+ 19.65	+ 1.39	+ 2.55	+ 0.86
	4	+ 16.69	- 1.32	+ 1.46	- 0.22
	7	+ 18.80	+ 1.41	+ 3.19	+ 2.04
Aug.	25	+ 19.97	- 0.30	- 1.76	- 2.16
	27	+ 19.41	+ 0.14	- 0.43	- 0.59
Sept.	8	+ 16.26	- 1.47	+ 0.89	- 0.67
Oct.	10	+ 16.03	- 3.71	- 0.70	+ 1.02
Oct.	24	+ 18.15	- 0.13	+ 1.03	- 0.58
	25	+ 16.53	- 1.35	+ 0.17	- 1.41
	28	+ 15.88	- 1.56	+ 1.20	+ 0.20
	31	+ 15.31	- 2.29	+ 0.46	+ 0.32
Nov.	1	+ 16.70	- 1.06	+ 0.98	+ 1.16
	4	+ 12.71	- 5.65	- 2.84	- 1.66
Nov.	24	+ 15.83	- 1.69	+ 4.24	+ 3.30
	29	+ 13.00	- 5.04	- 1.91	- 1.37
Dec.	8	+ 15.21	- 5.94	- 3.15	- 1.96
Dec.	23	+ 14.10	- 3.53	+ 0.51	- 0.11
	26	+ 10.24	- 7.88	- 1.97	- 1.56
	27	+ 13.68	- 4.66	- 1.68	- 0.92
	28	+ 13.29	- 5.42	- 2.88	- 1.78
Mean of Errors, without regard to sign		...15".649	4".246	1".754	1".184
Mean Errors for Year		+ 15".649	- 3".299		

TABLE III.

Mean Excess over Observation of the Moon's Tabular Place in Longitude for the years 1847 to 1887, as computed from Hansen's Tables.

"Uncorrected" and "Corrected" on and after 1864 for the change in Tabular Mean Time, introduced in the year 1864.

Year.	Errors of Longitude (Hansen minus Observed).	
	Uncorrected.	Corrected.
1847	+ 1'07	+ 1'07
1848	+ 0'20	+ 0'20
1849	- 0'47	- 0'47
1850	- 0'28	- 0'28
1851	- 1'29	- 1'29
1852	- 0'92	- 0'92
1853	- 1'63	- 1'63
1854	- 1'68	- 1'68
1855	- 0'87	- 0'87
1856	- 0'96	- 0'96
1857	- 1'86	- 1'86
1858	- 1'98	- 1'98
1859	- 1'80	- 1'80
1860	- 2'90	- 2'90
1861	- 2'19	- 2'19
1862	- 2'83	- 2'83
1863	- 1'61	- 1'61
1864	+ 0'12	- 0'81
1865	+ 1'27	- 0'22
1866	+ 2'14	- 0'22
1867	+ 3'48	+ 0'36
1868	+ 4'12	+ 0'28
1869	+ 4'28	- 0'35
1870	+ 4'83	- 0'66
1871	+ 6'96	+ 0'44
1872	+ 7'31	+ 0'10
1873	+ 8'24	+ 0'20
1874	+ 9'29	+ 0'56
1875	+ 9'87	+ 0'36
1876	+ 9'80	- 0'51
1877	+ 9'23	- 1'90
1878	+ 8'22	- 3'60
1879*	+ 9'63	- 3'12
1880	+ 10'89	- 2'77
1881	+ 10'51	- 4'06
1882†	+ 12'68	- 2'51
1883	+ 14'71	- 1'50
1884	+ 14'65	- 1'91
1885	+ 15'14	- 1'87
1886	+ 15'34	- 2'53
1887‡	+ 15'65	- 3'30

* All to 1879, Greenwich observations.

† 1880 to 1882, Mean of Greenwich and Radcliffe.

‡ 1883 and since, Radcliffe only.

Radcliffe Observatory, Oxford :
1888, January 9.